Incremental Evolution of a 10/250 NLV into a 20/450 NMSLV, Phase I

Completed Technology Project (2013 - 2013)

Project Introduction

The technical innovation proposed here is the continued functional evolution and concept refinement of an incremental series of test vehicles that will ultimately provide dedicated, low-cost, reliable, on-demand routine space access for the emerging nano and micro satellite markets. Initial orbital operational capability for delivering 10 kg to a 250 km circular LEO is achieved with a two-stage, pressure-fed "10/250" Nanosat Launch Vehicle (NLV) that will pathfind performance, production, regulatory and operational challenges. This NLV will then be followed by a clustered "20/450" Nano/Micro Satellite Launch Vehicle (NMSLV) that addresses this topic's primary objective of providing a capability to place nano and micro satellites weighing up to 20 kg into 450 km circular LEO. Aggressive leveraging of our team's existing NLV development initiative enables significant hardware development and the start of static fire testing during Phase I, followed by actual flight testing in Phase II for TRL-7 technology evaluations. These tests have incrementally introduced state of the art capabilities like advanced propellants (LOX/propylene) and structures (composite cryogenic tanks). The Phase I effort focuses on the development of the next class of test vehicle – a high altitude suborbital single booster stage (the "P-K") that features closed-loop thrust vector control (TVC) and candidate avionics technologies for guidance and navigation, as well as eventual autonomous flight termination systems (AFTS) for range safety, TRDRSS-based telemetry and tracking functions. In addition, it will incorporate features needed to implement the clustered first stage configuration and second stage separation method associated with the 20/450 NMSLV. The Phase II effort will then focus on the further development of an NMSLV-type first stage with two additional core boosters, for a total of three, and the conducting of a high-altitude demonstration flight.

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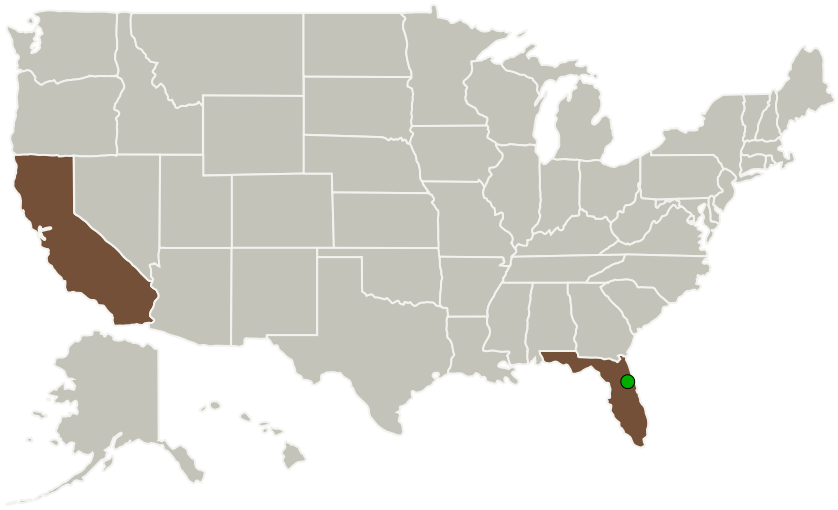
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Garvey Spacecraft Corporation	Lead Organization	Industry	Long Beach, California
Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations	
California	Florida

Project Transitions

May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138643)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Garvey Spacecraft Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

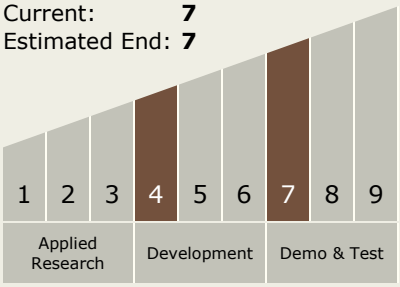
Carlos Torrez

Principal Investigator:

Christopher M Bostwick

Technology Maturity (TRL)

Start: **4**
Current: **7**
Estimated End: **7**



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Images

Project Image
Incremental Evolution of a 10/250 NLV into a 20/450 NMSLV
(https://techport.nasa.gov/image/127926)

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.3 Cryogenic

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System